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PROPERTIES OF REGULAR AND SUPER UNLEADED AUTOMOTIVE GASOLINES (---ETC(U)
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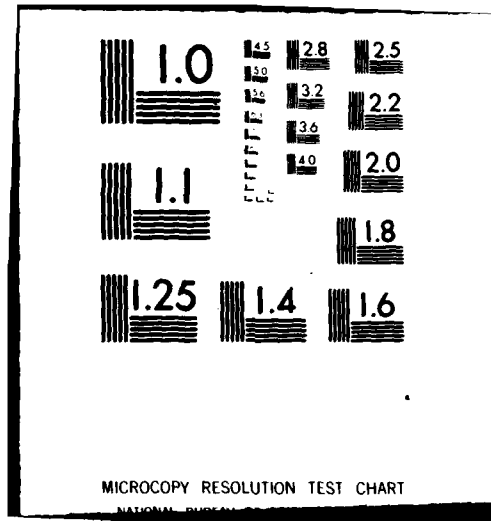
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**PROPERTIES OF REGULAR
AND SUPER
UNLEADED AUTOMOTIVE
GASOLINES**

(Ottawa/Hull Area – Winter, 1978-79)

by

**P.L. Strigner, G. Moroz, R. Sabourin,
G. Burton, T. Bailey**

Division of Mechanical Engineering

OTTAWA
JUNE 1979



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**MECHANICAL ENGINEERING
REPORT
MP-73**

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**PROPERTIES OF REGULAR AND SUPER UNLEADED AUTOMOTIVE
GASOLINES (OTTAWA/HULL AREA - WINTER, 1978/79)**

**(PROPRIÉTÉS DES ESSENCES AUTO DE TYPES SANS PLOMB RÉGULIER ET SUPER
(RÉGION OTTAWA/HULL - HIVER, 1978/79))**

by/par

**P.L. STRIGNER, G. MOROZ, R. SABOURIN,
G. BURTON, T. BAILEY**

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SUMMARY

Unleaded, automotive, winter grade gasolines, both regular (type 2) and super (type 1), sold in the Ottawa/Hull area by the major oil companies are all excellent in quality, meeting requirements of CGSB* Standards 3-GP-5 and 3-GP-5Ma for Unleaded Automotive Gasoline.

All the tested gasolines have nil or negligible lead and phosphorus contents indicating excellent protection against catalyst poisoning. Most gasolines have manganese, probably as the methylcyclopentadienyl manganese tricarbonyl antiknock agent.

* Canadian Government Specifications Board

RÉSUMÉ

Les essences auto de type sans plomb, régulier (type 2) et super (type 1), vendues dans la région Ottawa/Hull et distribuées par les principales compagnies pétrolières sont d'excellente qualité se conformant aux normes 3-GP-5 et 3-GP-5Ma de la ONGC* pour essence auto type sans plomb.

La quantité de plomb et de phosphore contenue dans toutes les essences analysées est inexistante ou négligeable assurant une excellente protection contre l'empoisonnement du catalyseur. La plupart des essences contiennent du manganèse, probablement sous forme de tricarbonyl méthylcyclopentadienyl de manganèse, agent antidétonnant.

* Office des normes du gouvernement canadien

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PROPERTIES OF REGULAR AND SUPER UNLEADED AUTOMOTIVE GASOLINES (OTTAWA/HULL AREA - WINTER, 1978/79)

1.0 INTRODUCTION

This survey of the physical, chemical and antiknock properties of unleaded automotive gasolines sold by the major oil companies in the Ottawa/Hull area in the winter of 1978/79 was made for two reasons: (1) To obtain data on unleaded gasolines used in the Environment Canada project employing cars in field service aimed at comparing the engine performance of two API service classification SE automotive oils, one formulated from virgin oil basestock and the other formulated from re-refined oil basestock (SAE viscosity grade: 20W-40). (2) To obtain and disseminate more widely this useful data on unleaded gasolines because of its general unavailability.

2.0 SAMPLES

One gallon quantities of each of fifteen unleaded automotive gasolines (8 regular and 7 super) were obtained from eight major oil company service stations in the Ottawa/Hull area in late February 1979. As the gasolines probably came from Quebec refineries, principally in Montreal, they are accordingly probably representative of gasolines sold in the Montreal/Quebec City as well as Ottawa/Hull region. Care was taken to ensure that the samples were uncontaminated and promptly capped to minimize vapour losses. Subsequently, they were stored in a refrigerator in the NRC Fuels and Lubricants Laboratory maintained at 32-40°F before testing, the Reid vapour pressure being determined first.

3.0 OIL COMPANIES

The unleaded winter gasolines, as noted, were obtained from the service stations of eight different oil companies. The oil companies are listed in alphabetical order. This order is unrelated to the order, or sample numbers shown in the Tables.

BP Canada
Golden Eagle Canada Limited
Gulf Oil Canada Limited
Imperial Oil Limited
Petrofina Canada Limited
Shell Canada Limited
Sun Oil Company Limited
Texaco Canada Limited

Seven oil company service stations dispensed both grades of unleaded gasoline. One of the company stations dispensed only the regular grade.

4.0 TESTS AND RESULTS

Tests performed on the unleaded gasolines were in all instances ASTM laboratory tests as stated in CGSB Standards 3-GP-5 or 3-GP-5Ma for Unleaded Automotive Gasoline (Ref. 1). Tests used were the latest published versions of the tests except for (1) the sulphur content which was determined by an old version, D90-34T, and (2) the manganese content, D3831, which is in the final stages of approval in ASTM, but not yet published.

All tests specified in 3-GP-5 and 3-GP-5Ma were performed. In addition, though, for information, several additional tests were done and data recorded. These were (1) API gravity and relative

density, (2) hydrocarbon types, (3) evaporation residue as described in the gum test, and (4) research octane number.

Results of all tests are presented in four tables, two of which present the results in the new metric or SI units and the other two in the old non-metric or superseded units. For purposes of determining compliance with 3-GP-5 and 3-GP-5Ma specification limits, the limits are shown in the Tables.

The data are presented as follows:

Table 1 — Properties of Regular Unleaded Gasolines — Metric Units*

Table 2 — Properties of Super Unleaded Gasolines — Metric Units.

Table 3 — Properties of Regular Unleaded Gasolines — Non-metric Units.

Table 4 — Properties of Super Unleaded Gasolines — Non-metric Units.

5.0 COMPLIANCE WITH CGSB SPECIFICATION 3-GP-5 (3-GP-5Ma)

An examination of the data in the four tables reveals that all of the unleaded automotive gasolines surveyed are of high quality. All meet all of the requirements of CGSB Specification 3-GP-5 or 3-GP-5Ma except for two super unleaded gasolines that appear to have a yellow rather than a green colour. Since this is a subjective test and the quality of the two gasolines is high and well within specification limits, the colour discrepancy is considered to have no effect on engine performance.

As noted both lead and phosphorus are either absent or present only in trace amounts in the gasolines indicating good protection for the anti-pollution catalyst. In large amounts, say in excess of the specification limits, both of these elements would soon destroy the catalyst. It is interesting to note that practically all unleaded gasolines, regular and super alike contain manganese as an antiknock agent, probably as methylcyclopentadienyl manganese tricarbonyl (MMT)*. Sulphur levels are very low in all gasolines indicating good metal protection from corrosion due to sulphur combustion products.

All gasolines have good oxidation stability and negligible gum contents.

Most of the super, unleaded gasolines have a high antiknock quality. In comparison with premium leaded gasolines which reached an average high of about 100 research octane numbers in the Ottawa/Hull area a few years ago, (Refs. 2, 3, 4) the current super unleaded gasolines have an average of 98 (some being over 98.5) research octane numbers.

Two other notable differences between these unleaded gasolines and earlier leaded gasolines are (1) the higher aromatic contents of the unleaded gasolines obviously to maintain a high antiknock quality in the absence of tetraethyl lead, and (2) the lower distillation end points of the unleaded gasolines to minimize the emission of unburned hydrocarbons. Two earlier NRC reports show the properties of leaded gasolines in the Ottawa/Hull area (Refs. 3, 4).

6.0 ACKNOWLEDGEMENT

The authors acknowledge with thanks the research and motor octane number data provided by Messrs. J. O'Connor and J. Thompson of the Quality Engineering Test Establishment, DND.

* Trade Mark of Ethyl Corporation.

7.0 REFERENCES

1. Canadian Government Specifications Board (CGSB) Standard 3-GP-5Ma for Unleaded Automotive Gasolines issued in November 1978. It supersedes the non-metric Standard 3-GP-5 issued in July 1976. Standards are available from Canadian Government Specifications Board, Ministry of Supply and Services, Canada, Hull, Quebec, Canada K1A 0S5.
2. Ethyl Corporation of Canada Limited, Monthly Gasoline Octane Quality Report. (Montreal/Quebec City data given in the Ethyl report are comparable to Ottawa/Hull data.)
3. Moroz, G.
Strigner, P.L. *Laboratory Inspections of Samples of Motor Gasolines.* Obtained from Local Service Stations for Algonquin Student Project. NRC, DME Report MPT-6853, National Research Council Canada, Ottawa, Ontario, May 20, 1970.
4. Friend, M.J. *Engine Performance Tests Using Leaded and Unleaded Gasolines.* NRC, DME Report MPT-7657, National Research Council Canada, Ottawa, Ontario, August 20, 1975.

TABLE 1

PROPERTIES OF REGULAR UNLEADED GASOLINES - METRIC UNITS

	ASTM Method	FLO 79050	FLO 79052	FLO 79054	FLO 79056	FLO 79058	FLO 79060	FLO 79062	FLO 79063	3-CP-5Ma (1) Winter
Colour	Visual (2)	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Undyed
Reid Vapour Pressure, kPa	D323	94	99	96	97	99	98	98	95	62 to 97 (3)
Relative Density at 15.56/15.56°C	D1298	0.7358	0.7205	0.7339	0.7305	0.7362	0.7242	0.7313	0.7408	No limit
Copper Strip Corrosion (3 hrs at 50°C)	D130	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Distillation	D86									
Initial Boiling Point, °C		26	27	26	28	26	29	27	27	No limit
10% Evaporated °C		41	42	37	38	38	38	38	39	52 max.
50% Evaporated °C		96	80	94	88	88	84	88	99	113 max.
90% Evaporated °C		161	168	158	154	147	167	156	158	185 max.
Final Boiling Point, °C		193	201	188	186	177	198	183	192	No limit
Recovery, % Vol.		95.7	96.4	95.3	94.6	94.7	95.8	95.1	94.3	No limit
Residue, % Vol.		1.4	1.5	1.6	1.5	1.4	1.5	1.4	1.5	No limit
Loss, % Vol.		2.9	2.1	3.1	3.9	3.9	2.7	3.5	4.2	No limit
Hydrocarbon Types										
Aromatics, % Vol.	D1319	34.4	25.4	32.9	32.4	37.2	28.8	38.0	36.6	No limit
Olefins, % Vol.		16.4	12.1	12.7	10.4	3.5	14.9	14.6	6.8	No limit
Saturates, % Vol.		49.2	62.5	54.5	57.2	59.3	56.3	47.4	56.6	No limit
Elements										
Lead, mgPb/L	D3237	4	2	2	0	0	2	0	0	13 max.
Phosphorus, mgP/L	D3231	0.1	0.3	0.3	0.1	0.3	0.1	0.3	0.3	1.3 max.
Manganese, mgMn/L	D3831	13	13	16	8	4	18	11	2	18 max.
Sulphur, % mass	D90-34T	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.15 max.
Gum and Stability										
Evaporation Residue, mg/100mL	D381	2.6	2.0	3.0	2.3	3.6	4.6	2.4	3.5	No limit
Existent Gum, mg/100mL (4)	D381	1.4	0.1	1.6	1.4	2.2	1.9	0.9	1.2	7 max.
Oxidation Stability, min.	D525	> 240	> 240	> 240	> 240	> 240	> 240	> 240	> 240	240 min.
Anti-Knock Quality (6)										
Research Octane No. (R.O.N.)	D2699	94.5	92.8	94.1	93.0	93.2	92.8	95.5	92.9	No limit
Motor Octane No. (M.O.N.)	D2700	84.3	84.6	84.6	84.9	84.8	87.0	84.7	84.8	82.0 min.
Anti-Knock Index	Note (5)	89.4	88.7	89.4	89.0	89.0	89.9	90.1	88.8	87.0 min.

- NOTES: (1) Specification issued in November 1978 (type 2, unleaded automotive gasoline).
 (2) During the visual examination the gasolines were examined for clarity and visible contaminants.
 All were clear. No visible contaminants were observed.
 (3) Limit is 103 max. between November 1 and February 28, incl.
 (4) Existent gum is the solvent-washed residue.
 (5) R.O.N. plus M.O.N. divided by 2.
 (6) Determined courtesy of the Knock Laboratory, QETE, DND.

TABLE 2
PROPERTIES OF SUPER UNLEADED GASOLINES — METRIC UNITS

	ASTM Method	FLO 79049	FLO 79051	FLO 79053	FLO 79055	FLO 79057	FLO 79059	FLO 79061	3-GP-5Ma (1) Winter
Colour	Visual (2)	Green	Yellow	Green	Green	Green	Yellow	Green	Green
Reid Vapour Pressure, kPa	D323	97	99	101	101	100	99	101	62 to 97 (3)
Relative Density at 15.56/15.56°C	D1298	0.7487	0.7405	0.7432	0.7271	0.7531	0.7412	0.7420	No limit
Copper Strip Corrosion (3 hrs at 50°C)	D130	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Distillation	D86								
Initial Boiling Point, °C		26	26	26	28	26	26	25	No limit
10% Evaporated, °C		38	35	36	36	36	35	37	52 max.
50% Evaporated, °C		92	97	87	96	99	98	88	113 max.
90% Evaporated, °C		159	174	148	142	151	176	151	185 max.
Final Boiling Point, °C		200	210	168	173	177	212	171	No limit
Recovery, % Vol.		95.5	96.2	95.5	94.3	93.9	96.2	95.3	No limit
Residue, % Vol.		1.4	1.5	1.5	1.5	1.4	1.4	1.7	No limit
Loss, % Vol.		3.1	2.3	3.0	4.2	4.7	2.4	3.0	No limit
Hydrocarbon Types	D1319								
Aromatics, % Vol.		44.6	39.4	45.6	31.5	49.7	37.8	41.0	No limit
Olefins, % Vol.		9.7	12.2	13.4	5.3	7.8	8.9	15.4	No limit
Saturates, % Vol.		45.7	48.4	41.0	63.2	42.5	53.3	43.6	No limit
Elements									
Lead, mgPb/L	D3237	8	2	8	2	0	2	0	13 max.
Phosphorus, mgP/L	D3231	0.1	0.3	0.3	0.1	0.3	0.3	0.3	1.3 max.
Manganese, mgMn/L	D3831	18	11	16	16	18	11	16	18 max.
Sulphur, % mass	D90-34T	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.15 max.
Gum and Stability									
Evaporation Residue, mg/100mL	D381	2.7	4.2	4.2	2.2	3.7	6.8	7.5	No limit
Existent Gum, mg/100mL (4)	D381	1.4	1.1	1.0	0.4	1.0	2.2	1.7	7 max.
Oxidation Stability, min.	D525	> 240	> 240	> 240	> 240	> 240	> 240	> 240	240 min.
Anti-Knock Quality (6)									
Research Octane No. (R.O.N.)	D2699	98.0	98.6	98.4	97.0	97.5	98.7	98.6	No limit
Motor Octane No. (M.O.N.)	D2700	86.6	87.6	86.3	87.9	86.7	86.8	86.6	No limit
Anti-Knock Index	Note (5)	92.3	93.1	92.4	92.4	92.1	92.8	92.6	90.0 min.

NOTES: (1) Metric specification issued in November 1978 (type 1, unleaded automotive gasoline).

(2) During the visual examination the gasolines were examined for clarity and visible contaminants. All were clear. No visible contaminants were observed.

(3) Limit is 103 max. between November 1 and February 28, incl.

(4) Existent gum is the solvent-washed residue.

(5) R.O.N. plus M.O.N. divided by 2.

(6) Determined courtesy of the Knock Laboratory, QETE, DND.

TABLE 3

PROPERTIES OF REGULAR UNLEADED GASOLINES - NON-METRIC UNITS

	ASTM Method	FLO 79050	FLO 79052	FLO 79054	FLO 79056	FLO 79058	FLO 79060	FLO 79062	FLO 79063	3-GP-5 (1) Winter
Colour	Visual (2)	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	No limit
Reid Vapour Pressure, psi	D323	13.6	14.3	13.9	14.1	14.4	14.2	14.2	13.8	14 max. (3)
API Gravity at 60° F	D287	60.8	64.9	61.3	62.2	60.7	63.9	62.0	59.5	No limit
Specific Gravity at 60/60° F	D287	0.7358	0.7205	0.7339	0.7305	0.7362	0.7242	0.7313	0.7408	No limit
Copper Strip Corrosion (3 hrs at 122° F)	D130	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Distillation	D86									
Initial Boiling Point, ° F		79	80	79	82	79	85	81	80	No limit
10% Evaporated, ° F		105	108	98	101	100	101	101	102	125 max.
50% Evaporated, ° F		204	176	201	190	191	183	191	210	235 max.
90% Evaporated, ° F		322	335	317	310	296	333	312	317	365 max.
Final Boiling Point, ° F		380	394	370	366	350	388	362	377	No limit
Recovery, % Vol.		95.7	96.4	95.3	94.6	94.7	95.8	95.1	94.3	No limit
Residue, % Vol.		1.4	1.5	1.6	1.5	1.4	1.5	1.4	1.5	No limit
Loss, % Vol.		2.9	2.1	3.1	3.9	3.9	2.7	3.5	4.2	No limit
Hydrocarbon Types	D1319									
Aromatics, % Vol.		34.4	25.4	32.9	32.4	37.2	28.8	38.0	36.6	No limit
Olefins, % Vol.		16.4	12.1	12.7	10.4	3.5	14.9	14.6	6.8	No limit
Saturates, % Vol.		49.2	62.5	54.4	57.2	59.3	56.3	47.4	56.6	No limit
Elements										
Lead, gPb/l.G.	D3237	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.06 max.
Phosphorus, gP/l.G.	D3231	0.000	0.002	0.001	0.000	0.002	0.000	0.002	0.001	0.006 max.
Manganese, gMn/l.G.	D3831	0.06	0.06	0.07	0.04	0.02	0.08	0.05	0.01	0.08 max. (4)
Sulphur, % by mass	D90-34T	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.15 max.
Gum and Stability										
Evaporation Residue, mg/100mL	D381	2.6	2.0	3.0	2.3	3.6	4.6	2.4	3.5	No limit
Existent Gum, mg/100mL (5)	D381	1.4	0.1	1.6	1.4	2.2	1.9	0.9	1.2	7 max.
Oxidation Stability, min.	D525	> 240	> 240	> 240	> 240	> 240	> 240	> 240	> 240	240 min.
Anti-Knock Quality (7)										
Research Octane No. (R.O.N.)	D2699	94.5	92.8	94.1	93.0	93.2	92.8	95.5	92.9	No limit
Motor Octane No. (M.O.N.)	D2700	84.3	84.6	84.6	84.9	84.8	87.0	84.7	84.8	82.0 min.
Anti-Knock Index	Note (6)	89.4	88.7	89.4	89.0	89.0	89.9	90.1	88.8	87.0 min.

- NOTES: (1) Specification issued in July 1976.
(2) During the visual examination the gasolines were examined for clarity and visible contaminants. All were clear. No visible contaminants were observed.
(3) Limit is 15 max. between November 1 and February 28, incl.
(4) Limit calculated from the recently issued metric specification, 3-GP-5Ma.
(5) Existent gum is the solvent-washed residue.
(6) R.O.N. plus M.O.N. divided by 2.
(7) Determined courtesy of the Knock Laboratory, QETE, DND.

TABLE 4

PROPERTIES OF SUPER UNLEADED GASOLINES - NON-METRIC UNITS

	ASTM Method	FLO 79049	FLO 79051	FLO 79053	FLO 79055	FLO 79057	FLO 79059	FLO 79061	3-GP-5 (1) Winter
Colour	Visual (2)	Green	Yellow	Green	Green	Green	Yellow	Green	Green
Reid Vapour Pressure, psi	D323	14.0	14.3	14.6	14.6	14.5	14.3	14.6	14
API Gravity at 60 °F	D287	57.5	59.6	58.9	63.1	56.4	59.4	59.2	No limit
Specific Gravity at 60/60 °F	D287	0.7487	0.7405	0.7432	0.7271	0.7531	0.7412	0.7420	No limit
Copper Strip Corrosion (3 hrs at 122 °F)	D130	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Distillation	D86								
Initial Boiling Point, °F		78	78	78	83	79	79	77	No limit
10% Evaporated, °F		101	95	97	97	96	97	98	125 max.
50% Evaporated, °F		198	206	189	204	211	208	190	235 max.
90% Evaporated, °F		319	345	299	288	303	348	304	365 max.
Final Boiling Point, °F		392	410	334	343	350	413	340	No limit
Recovery, % Vol.		95.5	96.2	95.5	94.3	93.9	96.2	95.3	No limit
Residue, % Vol.		1.4	1.5	1.5	1.5	1.4	1.4	1.7	No limit
Loss, % Vol.		3.1	2.3	3.0	4.2	4.7	2.4	3.0	No limit
Hydrocarbon Types	D1319								
Aromatics, % Vol.		44.6	39.4	45.6	31.5	49.7	37.8	41.0	No limit
Olefins, % Vol.		9.7	12.2	13.4	5.3	7.8	8.9	15.4	No limit
Saturates, % Vol.		45.7	48.4	41.0	63.2	42.5	53.3	43.6	No limit
Elements									
Lead, gPb/l.G.	D3237	0.04	0.01	0.04	0.01	0.00	0.01	0.00	0.06 max.
Phosphorus, gP/l.G.	D3231	0.000	0.001	0.001	0.000	0.002	0.001	0.002	0.006 max.
Manganese, gMn/l.G.	D3831	0.08	0.05	0.07	0.07	0.08	0.05	0.07	0.08 max.
Sulphur, % by mass	D90-34T	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.15 max.
Gum and Stability									
Evaporation Residue, mg/100mL	D381	2.7	4.2	4.2	2.2	3.7	6.8	7.5	No limit
Existent Gum, mg/100mL (4)	D381	1.4	1.1	1.0	0.4	1.0	2.2	1.7	7 max.
Oxidation Stability, min.	D525	> 240	> 240	> 240	> 240	> 240	> 240	> 240	240 min.
Anti-Knock Quality (6)									
Research Octane No. (R.O.N.)	D2699	98.0	98.6	98.4	97.0	97.5	98.7	98.6	No limit
Motor Octane No. (M.O.N.)	D2700	86.6	87.6	86.3	87.9	86.7	86.8	86.6	No limit
Anti-Knock Index	Note (5)	92.3	93.1	92.4	92.4	92.1	92.8	92.6	90.0 min.

NOTES: (1) Metric Specification 3-GP-5Ma for type 1 unleaded gasoline issued in November 1978.

Limits converted to non-metric units.

(2) During the visual examination the gasolines were examined for clarity and visible contaminants. All were clear. No visible contaminants were observed.

(3) Limit is 15 max. between November 1 and February 28, incl.

(4) Existent gum is the solvent-washed residue.

(5) R.O.N. plus M.O.N. divided by 2.

(6) Determined courtesy of the Knock Laboratory, QETE, DND.

<p>NRC, DME MP-73 National Research Council Canada. Division of Mechanical Engineering.</p> <p>PROPERTIES OF REGULAR AND SUPER UNLEADED AUTOMOTIVE GASOLINES (OTTAWA/HULL AREA - WINTER, 1978/79). Strigner, P.L., Moroz, G., Sabourin, R., Burton, G., Bailey, T. June 1979. 10 pp. (incl tables).</p> <p>Unleaded, automotive, winter grade gasolines, both regular (type 2) and super (type 1), sold in the Ottawa/Hull area by the major oil companies are all excellent in quality, meeting requirements of CGSB* Standards 3-GP-5 and 3-GP-5Ma for Unleaded Automotive Gasoline.</p> <p>All the tested gasolines have nil or negligible lead and phosphorus contents indicating excellent protection against catalyst poisoning. Most gasolines have manganese, probably as the methylcyclopentadienyl manganese tricarbonyl antiknock agent.</p> <p>* Canadian Government Specifications Board</p>	<p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Automobile fuels. 2. Gasoline. <ol style="list-style-type: none"> I. Strigner, P.L. II. Moroz, G. III. Sabourin, R. IV. Burton, G. V. Bailey, T. VI. NRC, DME MP-73 	<p>NRC, DME MP-73 National Research Council Canada. Division of Mechanical Engineering.</p> <p>PROPERTIES OF REGULAR AND SUPER UNLEADED AUTOMOTIVE GASOLINES (OTTAWA/HULL AREA - WINTER, 1978/79). Strigner, P.L., Moroz, G., Sabourin, R., Burton, G., Bailey, T. June 1979. 10 pp. (incl tables).</p> <p>Unleaded, automotive, winter grade gasolines, both regular (type 2) and super (type 1), sold in the Ottawa/Hull area by the major oil companies are all excellent in quality, meeting requirements of CGSB* Standards 3-GP-5 and 3-GP-5Ma for Unleaded Automotive Gasoline.</p> <p>All the tested gasolines have nil or negligible lead and phosphorus contents indicating excellent protection against catalyst poisoning. Most gasolines have manganese, probably as the methylcyclopentadienyl manganese tricarbonyl antiknock agent.</p> <p>* Canadian Government Specifications Board</p>	<p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Automobile fuels. 2. Gasoline. <ol style="list-style-type: none"> I. Strigner, P.L. II. Moroz, G. III. Sabourin, R. IV. Burton, G. V. Bailey, T. VI. NRC, DME MP-73 	<p>NRC No. 17630</p>
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